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(54) Title: POLYDIMETHYLSILOXANE CONTAINING COMPOSITION

(57) Abstract

A liquid polymer composition comprising polydimethylsiloxane and a solvent for an active agent which renders the agent active when dry.

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POLYDIMETHYLSILOXANE CONTAINING COMPOSITION

The present invention relates to a liquid polymer film composition which contains one or more bactericidal, fungicidal, algicidal, yeasticidal or moldicidal agents, its application to substantially continuous surfaces such as glass, its incorporation into a wide range of other materials such as coatings, cleaning materials, building materials and to articles treated with the composition.

A great deal of time and effort in a wide range of technical research areas is devoted to overcoming the problems of infection and cross infection in medical, industrial, commercial, domestic and marine environments.

Many compositions are known which contain bactericidal, fungicidal, algicidal, yeasticidal and moldicidal agents. However, such compositions are often toxic to humans or animals or are difficult to use because of their toxicity when wet. Many of these products are unsuitable for mixing with other materials as they either affect the properties of the other material or their own properties are affected.

Furthermore, products such as disinfectants of the type often used in food preparation areas are only effective when wet and can damage substantially continuous surfaces such as glass by staining or etching the surface.

It is one object of the present invention to provide a liquid polymer film composition which contains one or more bactericidal, fungicidal, algicidal, yeasticidal or moldicidal agents and which can be applied to substantially continuous surfaces such as glass without damaging the surface.

A further object of the present invention is to provide a liquid polymer film composition as set out in the immediately preceding paragraph which can be incorporated into other materials such as coatings, surfaces, or cleaning agents to give those materials sterilizing properties.

A still further object of the present invention is to provide a liquid polymer film composition as set out in the two immediately preceding paragraphs which is an effective sterilizer when dry and imparts sterilizing properties to an object to which it is applied for many months.

In a first aspect the present invention provides a composition consisting essentially of a polymer composition capable of adhering to a substantially continuous surface.

In a second aspect the present invention provides a composition consisting essentially of a polymer composition capable of incorporation into a material.

The polymer composition preferably comprises a mixture of isopropanol, butyl acetate, sulphuric acid and polydimethylsiloxane.

Preferably there is 87 - 91% isoproponal which preferably acts as a carrier, 1 - 6% of butyl acetate which preferably acts as a drying agent, 1.5 - 3% sulphuric acid which preferably acts as a scavenger and 3 - 6% polydimethylsiloxane (all percentages are by volume).

Preferably the composition includes at least one anti-bacterial agent and most preferably the composition includes two anti-bacterial agents, which may be the same or different.

The anti-bacterial agents suitable for use in the present invention may include amphoteric compounds, iodophores,

phenolic compounds, quaternary ammonium compounds, hypochlorites and nitrogen based heterocyclic anti-bacterial compounds.

Examples of amphoteric compounds include long chain N-alkyl derivatives of amino acids such as glycine, alanine and beta-amino butyric acid, particular examples being dodecyl beta-alanine, dodecyl beta-aminobutyric acid, dodecylamino-di (aminoethylamino) glycine and N-(3-dodecylamino) propylglycine.

The term iodophores as used herein refers to complexes of iodine or triodide with a carrier, such as a neutral polymer. The carrier typically is one which increases the solubility of iodine in water, provides a sustained release of the iodine and reduces the equilibrium concentrations of free iodine. Examples of polymeric carriers from which iodophore compositions can be made include polyvinylpyrolidone, polyether glycols such as polyethylene glycols, polyvinyl alcohols, polyacrylates, polyamides, polyalkylenes and polysaccharides. A preferred iodophore is povidone iodine, in which the carrier is polyvinylpyrrolidone.

Examples of quaternary ammonium compounds include compounds of the general formula $R^1R^2N^+R^3R^4X^-$ wherein or one or two of the R groups are alkyl chains optionally substituted by an aryl group, or optionally interrupted by an aryl group or a heteroatom such as oxygen, and the other R groups are the same or different and are C_1-C_4 alkyl groups and in particular methyl groups. Examples of classes of quaternary ammonium compounds within this general formula include benzalkonium halides, aryl ring substituted benzalkonium halides such as ethyl-substituted benzalkonium halides (e.g. Barquat 4250 available from Lonza), and twin chain quaternary ammonium compounds such as dialkyldimethyl ammonium compounds wherein the two non-methyl alkyl groups are selected from medium and

long chain alkyl groups such as octyl groups and dodecyl groups. Examples of quaternary ammonium compounds in which an alkyl group R contains an oxygen heteroatom include domiphen bromide, benzalkonium chloride and methylbenzalkonium chloride.

Other examples of quaternary ammonium compounds include alkylpyridinium compounds such as cetylpyridinium chloride and bridged cyclic amino compounds such as the hexaminium compounds, e.g: N-(3-chloraliyl) hexaminium chloride.

Examples of phenolic compounds include methyl, halo- and aryl substituted phenolic compounds such as 2-phenylphenol, 2-benzyl-4-chlorophenol-, 2-cyclopentyl-4-chlorophenol, 4-t-amylphenol, 4-t-butylphenol, 4-chloro-2-pentylphenol, 6-chloro-2-pentylphenol, p-chloro-meta-xylenol, 2,4,4 trichloro-2- hydroxydiphenol, thymol (2-i-propyl-3-methylphenol), chlorothymol, 3-methyl-4-chlorophenol, 2,6, dichloro-4-n-alkyl phenols, 2,4-dichloro-meta-xylenol, 2,4,5-trichlorophenol and 2-benzyl-4-chlorophenol.

Examples of hypochlorites include alkali-metal and alkaline earth metal hypochlorites such as lithium hypochlorites, sodium hypochlorites, potassium hypochlorites, calcium hypochlorites, and chlorinated trisodium phosphate and their various hydrates. Other chlorine-containing or chlorine releasing agents include chlorine dioxide and its precursors, as well as 4-sulpho-dichloramido-benzoicacid (halazone), 1 ,3-dichloro-5-5-dimethylhydantoin (halane), and various chloroisocyanuric acid derivatives.

Examples of nitrogen-containing anti-bacterial agents include pyridine derivatives such as 4-pyridine carboxylic acid hydrazide, sodium 2-pyridinethiol -1-oxide (Sodium Omadine™) bis-(2-pyridylthic zinc 1, 1-dioxide (zinc Omadine), triazoles and imidazoles such as 2-(4-thiazolyl)

benzimidazole (Metasol T K-100); 12-benzisothiazoline-3-one (Proxcel™) 2-n-octyl-4-isothiazolin-3-one (Kathen™), 2-bromo-2-nitro-1-3-propanediol), (Bromonopol™), 3-trifluomethyl-4, 4'-dichlorocarbanilide (Irgasan™) quinacrine hydrochloride (Atabrine™), ciprofloxacin and nalidixic acid and its various derivatives.

The anti-bacterial agent or combination of anti-bacterial agents selected will depend on the polymer composition and on the intended use of the end product.

Preferably the anti-bacterial agent is contained in a non-volatile carrier. The non-volatile carrier may be a glycol, an ester derivative of a glycol or an ether derivative of a glycol. In particular, alkylene glycols and polyalkylene glycols such as diethylene glycol, hexylene glycol, propylene glycol and polyethylene glycol are used. The most preferred glycol carrier is diethylene glycol (DEG).

Alternatively, the carrier may be an alcohol having a high number of carbon atoms, preferably at least six carbon atoms, more preferably at least eight carbon atoms and most preferably at least ten carbon atoms.

Preferably the composition further includes at least one surfactant. Preferably the surfactant includes an amphoteric, an ionic and a non-ionic surfactant. An example of such a surfactant is PERSIL™ washing up liquid manufactured by Lever Brothers.

The compound is preferably diluted with water to provide a final product.

The polymer composition acts as a key to introduce the anti-bacterial agents to the substantially continuous surface, to adhere them thereto to protect that surface and also to

incorporate the anti-bacterial agents into other materials and especially to allow incorporation of the composition into oil or water based products.

In a third aspect the present invention provides materials incorporating the composition of the present invention.

Such materials may include coatings such as paints and varnishes, which may be oil based or water soluble. The composition may be incorporated into settable or curable compositions such as fillers, grouts, adhesives, mastics, putties and other materials which form a solid matrix over a period of time. Such compositions are prone to the growth of mold and fungus, particularly in damp environments such as bathrooms and kitchens.

The composition of the present invention may include a co-solvent or a co-diluent which evaporates readily. The co-solvent or co-diluent may be aqueous or non-aqueous, depending upon the nature of the material with which it is to be mixed.

The composition can also be incorporated into plastics materials which can then be used to manufacture food processing implements, work surfaces, packaging materials, containers, floor and wall cladding materials, bathroom and kitchen furniture.

When the composition is incorporated into materials including those detailed above the surfactant aids mixing of the material and the composition.

A fourth aspect of the present invention provides a substantially continuous surface coated with the composition of the present invention.

The surface is preferably glass, which may then be used in a variety of places such as hospitals, where sterility is of great importance.

The surface may alternatively be a metal, for example, door touch plates, door and window furniture, metal kitchen furniture, especially that used in restaurants.

The surface may alternatively be a plastics material, for example, toilet seats, bathroom furniture, work surfaces and kitchen implements. The surface may alternatively be a glazed ceramic surface such as floor and wall tiles.

The composition may be used in the components of ventilation and air conditioning systems, for example, the conduits, panels, grills and filters may incorporate or be coated with the composition of the present invention.

The polymer composition of the present invention adheres to substantially continuous surfaces without damaging them and as a result forms a coating layer on the surface which contains anti-bacterial agents, so that any bacteria present on or subsequently contacting the surface are eliminated.

The surfactant in this case acts to help the composition to spread over a substantially continuous surface and imparts cleaning and detergent properties to the composition.

The polymer composition works even when it is dry. This is believed to be because even when the surface appears to be dry a low concentration of the anti-bacterial compound is still present as a solution in the non-volatile carrier.

The materials into which the composition of the present invention are incorporated may include other agents such as bactericidal agents, biocidal agents, algicidal agents,

fungicidal agents and moldicidal agents as well as other standard additives for the material in question.

The composition and articles of the present invention have anti-bacterial effect against a wide range of gram-positive and gram-negative bacteria, such as: Bacillus cereus, Bacillus subtilis, Brevibacterium ammoniagenes, Brucella abortus, Klebsiella pneumonia, Lactobacillus casei, Proteus vulgaris, Listeria monocytogenes, Pseudomonas aeruginosa, Salmonella gall inarum, Salmonella typhosa, Staphylococcus aureus, Streptococcus faecalis, Flavobacterium species, Bacillus species, Esehericnia species, Aeromonas species, Anchromobacter species and Alcaligenes species. The compositions and articles of the present invention also have activity against fungi such as: Cephalosporium species, Cladosporium species, Fusarium species, Paecilomyces species, Penicillium species, Streptomyces species, Trichopliytoninterdigitale, Chaetorariumglobesom, Aspergillus niger, and Cenipliora putealla. yeasts such as Monilia albicans and Saccharomyces cerevisiae, and algae such as Chlorella pyrenoidosa and Anabaena cylindrica.

In a fifth aspect the present invention provides a method of imparting sterilizing properties to a substantially continuous surface by applying thereto a composition consisting essentially of a polymer film composition including at least one and preferably two anti-bacterial agents incorporated in a non-volatile carrier.

In a sixth aspect the present invention provides a method of imparting sterilizing properties to materials by incorporating therein a composition consisting essentially of a liquid polymer film composition including at least one and preferably two, anti-bacterial agents incorporated in a non-volatile carrier.

The composition preferably includes a surfactant, especially when the composition is incorporated into materials.

The composition may further include a preservative, and a co-solvent which readily evaporates off.

The present invention will be illustrated, merely by way of example, as follows:

Composition of the present invention (named 42AP)

1) Polymer composition (all percentages are by volume)

Isopropanol	87 - 91%
Butyl acetate	1 - 6%
Sulphuric acid	1.5 - 3%
Polydimethylsiloxane	3 - 6%

2) Surfactant composition

Anionic surfactant	15 - 30%
Non-ionic surfactant	1 - 5%
Amphoteric surfactant	1 - 5%
Ethanol	1 - 5%
Preservative	1 - 5%

3) First anti-bacterial agent composition

5-chloro-2-methyl-4-isothiazolin-3-1-ones
2-methyl-4-isothiazolin-3-ones; and
85% Diethylene glycol

4) Second anti-bacterial agent composition

Alkyldimethyl-benzylammonium chloride; and

50% Diethylene glycol

An example of the polymer film composition containing anti-bacterial agents is made by the following steps:-

a) Prepare the first and second anti-bacterial compositions and mix them together in a 1:1 ratio by volume;

b) Mix water with the anti-bacterial composition mixture in a 2:1 ratio by volume of water to anti-bacterial mixture.

c) Add 100ml of the dilute anti-bacterial agent mixture to 200ml of the surfactant composition;

d) Add 100ml of the polymer composition to the surfactant and anti-bacterial agent mixture;

e) Add 600ml of water to the mixture and mix well to give the polymer film composition of the present invention incorporating anti-bacterial agents.

This product can now be used on substantially continuous surfaces to impart an anti-bacterial film or it can be incorporated into a variety of other materials as herein before described. If the product is to be incorporated into oil based materials it will be used in its concentrated form (i.e. step e) will be omitted.

Examples of the Anti-bacterial Nature of the Composition of the Present Invention

Example 1

Two panes of glass were treated, i.e. coated with the active liquid polymer composition, which was allowed to dry. The coated glass panes were then placed in sealed bags. A further

untreated (control) pane of glass was also placed in a sealed bags. The panes of glass were then stored for three weeks before being submitted for microbiological testing by P.H.L.S. Poole Hospital, Poole Dorset. The micro-organism used in this test was Methicillin Resistant Staphylococcus aureus. (M.R.S.A.).

Method

A broth culture of a wild strain of methlcillin-resistant staphylococcus aureaus (MRSA) was grown in peptone saline diluent for 20 - 24 hours.

Serial decimal dilutions were then prepared in peptone saline diluent and a surface drop (Miles and Misra) count performed on blood agar. Plates were incubated at 30°C for 18 hours, colonies counted and counts estimated for each dilution.

Two dilutions (1 and 3) were used for inoculation. Dilution 1 contained 14,000 organisms per 20µl and dilution 3 contained 140 organisms per 20µl. Volumes of 20µl of each dilution were applied to each of the three plates and left in contact for a range of times from 0 seconds to 6 hours.

After the designated time the liquid from each inoculation was aspirated and pipetted onto the surface of a blood agar plate. If the inoculum had dried, 20µl of sterile distilled water was applied, carefully mixed and then aspirated. The aspirate was spread over the agar surface using a sterile spreader. Plates were incubated at 30°C for 18 hours and then colonies counted.

Results

Counts obtained are shown in the tables. Plate 1 showed a reduction in count over 5 minutes with no recovery after 10 minutes. For the heavier inoculum of 14,000 organisms, this

represents a four log reduction within 10 minutes and a 97.98% reduction within 5 minutes. Plate 2 showed a 3.5 log or 99.95% reduction within 1 minute and a four log reduction (100%) within 2 minutes.

It will be noted that there was a slight reduction on the control plate with time; this was most likely due to the effect of drying, as all inocula had dried out after 1-1.5 hours.

Conclusion

The treatment used for plate 2 resulted in 100% reduction of an inoculum of 14,000 MRSA organisms within 2 minutes and 99.95% reduction within 1 minute.

The treatment used for plate 1 resulted in 100% reduction of an inoculum of 14,000 MRSA organisms within 10 minutes and 97.98% reduction within 5 minutes.

Contact Time	Plate 1	Plate 2	Control
Inoculum	14000	14000	14000
0 min	Uncountable	Uncountable	Uncountable
1 min	Uncountable	7	Uncountable
2 min	2000 approx	0	Uncountable
5 min	283	0	Uncountable
10 min	0	0	Uncountable
30 min	0	0	Uncountable
1 hour	0	0	2000 - 5000
2 hour	0	0	281
3 hour	0	0	248
4 hour	0	0	195
5 hour	0	0	128

Time	Plate 1	Plate 2	Control
Inoculum	140	140	140
0 min	112	72	108
1 min	54	26	106
2 min	28	0	99
5 min	12	0	127
10 min	0	0	90
30 min	0	0	35
1 hour	0	0	18
2 hour	0	0	1
3 hour	0	0	1
4 hour	0	0	1
5 hour	0	0	0
6 hour	0	0	0

Example 2

Approximately 50 ml of clear colourless liquid (42AP) was submitted for microbiological testing by P.H.L.S Poole Hospital, Poole, Dorset in a clear plastic screwtop bottle. The concentration was said to be 15 ml liquid polymer diluted to 50 ml.

Method

A 1 ml volume of the liquid was inoculated with 20µl of an undiluted overnight broth of MRSA; this inoculum was estimated to contain 10^7-10^8 organisms. Using a fresh sterile pipette tip each time, a 20µl volume was immediately withdrawn and another 20µl volume withdrawn after 1, 2, 5, 10, 30 and 60 minutes. This volume was spread over the surface of a blood agar plate which was then incubated at 30°C for 20 hours. After incubation plates were examined for the presence of colonies.

Results

No colonies of MRSA were recovered on any plate.

Conclusion

An inoculum of approximately 10^7 organisms was killed within 10 seconds when added to 1 ml of 'D' stage 1 surface preparation (where D is 42AP).

Example 3

A detergent/cleaner called Enviroclene was obtained from H. Marcel Guest Ltd., Manchester, in a concentrated form. 30ml of the concentrate was diluted 15:1 with water and mixed by

conventional methods. 30ml of 42AP concentrate was then added to the diluted detergent/cleaner. After mixing, the product (a clear mobile liquid) was then submitted for microbiological testing by Microbac Analytica Ltd Consett Co. Durham.

Example 4

A detergent/cleaner called Deep-Clean was obtained from MGM Ltd Southampton in a concentrated form. 30ml of concentrate was diluted 15-1 with water and mixed by conventional methods. 30ml of 42AP concentrate was then added to the diluted detergent/cleaner. After mixing, the product (a light pink coloured mobile liquid) was then submitted for microbiological testing by Microbac Analytica Ltd Consett, Co. Durham.

Example 5

A detergent/cleaner called MGMx was obtained from MGM Ltd Southampton in a concentrated form. 30ml of concentrate was diluted 15-1 with water and mixed by conventional methods. 30ml of 42AP concentrate was then added to the diluted detergent/cleaner. After mixing, the product (a light straw coloured mobile liquid) was then submitted for microbiological testing by Microbac Analytica Ltd Consett Co. Durham.

The principle of the test requires that the product under test, diluted in hard water, shall demonstrate at least a 10^5 reduction in viable count when tested under simulated clean conditions (0.3 g/l bovine albumin) and dirty conditions (3 g/l bovine albumin).

While the original procedure determines that the test should be undertaken at 20°C, concern has been expressed that the temperature does not adequately reflect the temperatures experienced during application of the product.

In most food processing companies, the environment is controlled in such a way as to discourage the growth of pathogenic micro-organisms and working temperatures are usually well below the 20°C specified in the suspension test methodology. As most chemical/biochemical reactions occur more rapidly at higher temperatures, it has been suggested that biocides which work effectively at 20°C may display reduced efficacy at lower temperatures.

Initial testing on a number of products has indicated that the biocidal activity is adversely affected at 10°C.

The following tests were undertaken to determine the efficiency at 10°C.

Test Samples:

The three samples comprised Environclene FS Active Polymer D, Deep-Clene FA Active Polymer D and MGMX FS Active Polymer D which are subsequently diluted with potable water to provide a 1% working concentration. Prior to testing, all samples were stored at room temperature, in dark conditions. The samples were tested on 9th January 1997.
(Active polymer D is 42AP). Sample and storage details are summarised in Table 1.

Methodology:

The method used to assess the bactericidal activity of the samples is detailed in Appendix I of the Bacterial Activity Suspension Test specified by European Standard (Final Draft) Pr EN 1276: November 1995.

The test conditions were as described in Appendix 1, Section 5,5,2,2 (Dilution neutralisation method) with the following modifications:

(i) Temperature:

The tests were undertaken at 10°C only. The temperature was controlled throughout the test procedure at 10°C±1°C using a temperature controlled coolant waterbath.

(ii) Bacterial strains:

Only one organisms, Pseudomonas aeruginosa, was used for the purpose of this test.

The neutraliser selected from Annex B of the appended method comprised 30 g/l Polysorbate 80 and 3 g/l Lecithin.

The experimental conditions are summarised in Table 2.

Verification of Methodology:

Several control procedures were undertaken to ensure that the materials used did not affect the validity of the final result. (Appendix 1, section 5.6.2.)

Results:

The results of the tests are shown in Table 3. All of the formulations, when exposed to the test organism, Pseudomonas aeruginosa, for five minutes at 10°C, reduced the viable count by, greater than 10^5 as specified in the method. In all cases total kill was achieved.

Conclusions:

According to the test procedure, Enviroclene FS Active Polymer D, Deep-clene FS Active Polymer D and MGMX FS Active Polymer D, possess the required bacterial activity specified by the Suspension Test at 10°C.

BACTERIAL ACTIVITY SUSPENSION TEST

TABLE 1 - SAMPLE AND STORAGE DETAILS

Identification of the samples:

Name of Products:	Enviroclene FS Active Polymer D Deep-clene FS Active Polymer D MGMX FS Active Polymer D
Manufacturer:	Research Holdings Ltd.
Date of Delivery:	18/11/96
Storage Conditions:	Room Temperature and Darkness
Product Diluent Recommended by the Manufacturer for use:	Potable Water
Active Substance(s) and their Concentrations:	Neat

BACTERIAL ACTIVITY SUSPENSION TEST

TABLE 2 - TEST METHOD AND EXPERIMENTAL CONDITIONS

Test Method and its Validation:

Method:	Dilution Neutralisation:
Neutraliser:	30 g/l Polysorbate, 80 3 g/l Lecithin
Product Diluent Used During the Test:	Sterile Hard Water 300 mg/Kg $CaCO_3$
Product Test Concentration:	As received
Contact Time:	5 min ± 10 seconds
Test Temperature:	10°C ± 1°C
Interfering Substance: (Clean Conditions)	0.3 g/l of Bovine Albumin
Interfering Substance: (Dirty Conditions)	3.0 g/l of Bovine Albumin
Stability of the Mixture: (interfering substance and product diluted in hard water)	Precipitate absent throughout the test
Temperature of Incubators:	37°C ± 1°C
Bacterial Strain Used:	Pseudomonas aeroginosa NCTC 10332

BACTERIAL ACTIVITY SUSPENSION TEST

TABLE 3 - TEST RESULTS

	Enviro-clene FS Active Polymer D	Deep-clene FS Active Polymer D	MGMX FA Active Polymer D
Initial Concentration of Microorganism (cfu/ml)	8×10^8	8×10^8	8×10^8
Experimental Concentration (cfu/ml)	8×10^6	8×10^6	8×10^6
Pass Level (cfu/(ml)	<80	<80	<80
Actual Count at 37°C Clean Conditions (Average of Duplicate Plates)	0	0	0
Actual Count 37°C Dirty Conditions (Average of Duplicate Plates)	0	0	0
Pass/Fail	Pass	Pass	Pass

CLAIMS

1. A liquid polymer composition comprising polydimethylsiloxane and a solvent for an active agent.

2. A liquid polymer composition as claimed in claim 1 comprising a surface adhesion promoter to assist the adherence of the composition to a substantially continuous surface.

3. A liquid polymer composition as claimed in claim 2 wherein the surface adhesion promoter is a strong acid.

4. A liquid polymer composition as claimed in claim 2 or 3 wherein the surface adhesion promoter is sulphuric acid, phosphoric acid, sulphamic acid, hydrochloric acid, nitric acid, hydrofluoric acid or chromic acid or a mixture thereof.

5. A liquid polymer composition as claimed in claim 2, 3 or 4 wherein the surface adhesion promoter is sulphuric acid.

6. A liquid polymer composition as claimed in any preceding claim wherein the solvent is butyl acetate or isopropanol or a mixture thereof.

7. A liquid polymer composition as claimed in any preceding claim comprising isopropanol, butyl acetate, sulphuric acid and polydimethylsiloxane.

8. A liquid polymer composition as claimed in any preceding claim comprising (percentages by volume): 88-97% of a solvent for an active agent, 3-6% polydimethylsiloxane and optionally 1.5-3% of a surface adhesion promoter.

9. A liquid polymer composition as claimed in any preceding claim comprising (percentages by volume):

isopropanol	87-91%

butyl acetate 1-6%
sulphuric acid 1.5-3%
polydimethylsiloxane 3-6%.

10. A liquid polymer composition as claimed in any preceding claim comprising at least one of the active agents selected from the group consisting of a biocidal, anti-microbial, germicidal, bactericidal, fungicidal, yeasticidal, moldicidal, algicidal or virucidal agent.

11. A liquid polymer composition as claimed in any preceding claim comprising at least one anti-microbial agent.

12. A liquid polymer composition as claimed in any preceding claim comprising at least two anti-microbial agents.

13. A liquid polymer composition as claimed in any of claims 10 to 12 wherein the or each anti-microbial agent is effective against gram-positive and gram negative bacteria.

14. A liquid polymer composition as claimed in any of claims 10 to 13 comprising an ani-microbial agent selected from the groups consisting of amphoteric compounds, iodophores, phenolic compounds, quaternary ammonium compounds, hypochlorites and nitrogen based heterocyclic compounds.

15. A liquid polymer composition as claimed in any of claims 10 to 14 wherein the or each active agent is contained in a non-volatile carrier.

16. A liquid polymer composition as claimed in claim 15 wherein the carrier is a glycol or an alcohol having a high number of carbon atoms.

17. A liquid polymer composition as claimed in claim 15 or 16 wherein the carrier is diethylene or monopropylene glycol.

18. A liquid polymer composition as claimed in any preceding claim comprising a surfactant or detergent.

19. A liquid polymer composition as claimed in any preceding claim comprising an aqueous or non-aqueous co-solvent or co-diluent which evaporates rapidly.

20. A liquid polymer composition as claimed in any of claims 10 to 19 which is active when dry.

21. A liquid polymer composition as claimed in any preceding claim incorporated into a functional material.

22. A liquid polymer composition as claimed in claim 21 wherein the functional material is a coating material, a cleaning material or a building material.

23. A liquid polymer composition as claimed in claim 21 or 22 wherein the functional material is paint or a powder coating.

24. A substantially continuous surface coated with a composition as claimed in any of claims 1 to 23.

25. A substantially continuous surface as claimed in claim 24 which is a glass, metal, plastic, composite or ceramic surface.

26. A substantially continuous surface as claimed in claim 24 or 25 which is a glass surface.

27. A building component comprising a substantially continuous surface as claimed in any of claims 24 to 26.

28. A method for substantially sterilizing a substantially continuous surface comprising:
applying to said surface a composition as claimed in any of claims 10 to 23.

29. A method for substantially sterilizing a functional material comprising:
incorporating in said functional material a composition as claimed in any of claims 10 to 23.

30. A composition, substantially continuous surface, building component or method as hereinbefore described with reference to the accompanying Examples.

INTERNATIONAL SEARCH REPORT

Intern nal Application No
PCT/GB 99/01881

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A01N25/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A01N C08K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 689 767 A (BECTON DICKINSON AND COMPANY) 3 January 1996 (1996-01-03) * see the whole document* ---	1-21, 28-30
X	DATABASE WPI Derwent Publications Ltd., London, GB; AN 1988-143759 XP002118187 DAIWA KAGAKU KOGYO KK: "Washing-resistant sanitary finishing of textile material-by polymerizing polydimethylsiloxane on textile and applying bactericide and /or fungicide " abstract & JP 63 085181 A --- -/--	1,6,8, 10-16, 20,21, 28-30

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 October 1999	22/10/1999
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Fort, M

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INTERNATIONAL SEARCH REPORT

Interna[illegible]al Application No
PCT/GB 99/01881

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 99 18784 A (RHODIA CHEMIE) 22 April 1999 (1999-04-22) * see the whole document *	1,2,10, 11,14, 18, 20-22, 24-30
X	US 5 147 575 A (RONALD S. HAMPTON) 15 September 1992 (1992-09-15) column 3, line 62 -column 5, line 16	1,10,11, 15, 20-25, 28-30
X,P	US 5 882 387 A (MARTIN ET AL.) 16 March 1999 (1999-03-16) column 2, line 11 -column 4, line 27 & CA 2 212 901 A 26 February 1998 (1998-02-26)	1,20-22, 24-26, 28-30
X	WO 91 13608 A (RÖLLA ET AL.) 19 September 1991 (1991-09-19) page 2, line 18 -page 3, line 25	1,20,21, 28,30
X	US 5 720 804 A (F.L.MARTIN) 24 February 1998 (1998-02-24) column 6, line 32 - line 44 example 1	1,2,6

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INTERNATIONAL SEARCH REPORT

...rmation on patent family members

Intern...nal Application No
PCT/GB 99/01881

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		JP 2638575 B	06-08-1997
		JP 8040883 A	13-02-1996
		US 5629006 A	13-05-1997